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REMARKS

This response is intended as a full and complete response to the non-final Office Action mailed June 17, 2004. In the Office Action, the Examiner notes that claims 1-27 are pending, of which claims 1-27 stand rejected. By this response, claims 1 and 17 are amended, claim 19 is canceled, new claims 28-30 are added, and claims 2-16, 18, and 20-27 continue unamended.

In view of the following discussion, the Applicants submit that none of the claims now pending in the application are anticipated or obvious under the provisions of 35 U.S.C. §§102 or 103. Thus, the Applicants believe that all these claims are now in allowable form.

It is to be understood that the Applicants, by amending the claims, do not acquiesce to the Examiner's characterizations of the art of record or to Applicants' subject matter recited in the pending claims. Further, Applicants are not acquiescing to the Examiner's statements as to the applicability of the prior art of record to the pending claims by filing the instant responsive amendments.

REJECTIONS

35 U.S.C. §102

Claims 1-4, 10 and 11

The Examiner has rejected claims 1-4, 10 and 11 under 35 U.S.C. §102(b) as being anticipated by Hanco et al. (USPN 5649093, hereinafter "Hanco"). Applicants respectfully traverse the rejection.

Applicants' independent claim 1 recites:

"A method for streaming content striped in RAID 5 format from an array of disk drives to a plurality of subscribers to minimize disruptive service from a disk drive failure, said method comprising:
accessing content data on an extent-by-extent basis from a plurality of disk drives configured in an array;
streaming the content data to the plurality of subscribers on an extent-by-extent basis, sequentially, from the plurality of disk drives;
detecting an actual disk drive failure;
transitioning to a stream regeneration mode of operation
comprising:

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reading the content data contemporaneously from all extents in a parity group associated with a failed disk drive;
regenerating a failed portion of the content data from a failed extent in the parity group corresponding to the failed disk drive; and
streaming the content data in the parity group to the plurality of subscribers, extent-by-extent, immediately following the regenerating of the content data from the failed extent in the parity group." (emphasis added).

Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim" (*Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 221 USPQ 481, 485 (Fed. Cir. 1984)(citing *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 220 USPQ 193 (Fed. Cir. 1983).

Hanko teaches:

"In one embodiment, the mass storage system includes a server controller, a cluster of data disk drives and a parity drive associated with the cluster of data disk drives. The controller provides video data streams to a number of viewers. Data is stored as contiguous data strips in the cluster of data drives. Each data strip includes a plurality of contiguous data slices logically distributed across the cluster of data drives. A plurality of parity slices, each parity slice corresponding to each data strip, is stored in the parity drive.

During normal operation, i.e., when all the data drives are functional, there is no need to read the parity drive. The data slices stored in the respective data drives are read as needed in a "just-in-time" (JIT) protocol. When the failure of one of the data drives is detected, the parity drive is read in place of the failed drive. Using a modified JIT protocol, all functional data drives are read along with the parity drive before the erroneous slice is needed. A replacement data slice is reconstructed from the parity slice and remaining data slices." (See, Hanko, column 3, lines 30-46.)

Hanko fails to disclose each and every element of the claimed invention, as arranged in the claim. In particular, Hanko does not teach or suggest "reading the content data contemporaneously from all extents in the parity group." Specifically, where a disk drive 320 has failed, the server 310 transitions from the carousel-serving algorithm 334 to the stream regeneration algorithm 339. The basic concept underlying the stream regeneration algorithm 339 is to switch from the RAID 5 format of reading

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each extent 402 one at a time, to the RAID 3-like format of reading the entire parity group simultaneously. In particular, the bad (i.e., failed) disk drive is no longer accessed, however, all the extents across the other disk drives 320 are read in the parity group 404. The parity information 410 is then used to reconstruct (regenerate) the missing true data from the defective disk drive. (See Applicants' specification, page 12, lines 17-26; emphasis added). By contrast, Hanko teaches away from the Applicants' invention, since each good drive is read in different preceding time slots when reconstructing the lost data. Therefore, each and every element of the claimed invention, arranged as in claim 1, is not taught, or even suggested, by Hanko.

As such, the Applicants submit that independent claim 1 is not anticipated under 35 U.S.C. §102 and is fully patentable thereunder. Furthermore, claims 2-3, 10 and 11 depend, either directly or indirectly, from independent claim 1 and recite additional limitations thereof. As such and for at least the same reasons, the Applicants submit that these dependent claims are not anticipated under 35 U.S.C. §102 and are fully patentable thereunder. Therefore, the Applicants respectfully request that the rejections of claims 2-3, 10 and 11 be withdrawn.

35 U.S.C. §103

Claims 5-9, 12-16

The Examiner has rejected claims 5-9, 12-16 under 35 U.S.C. §103(a) as being unpatentable over Hanko in view of Peters et al. (USPN 6415373, hereinafter "Peters"). Applicants respectfully traverse the rejection.

The test under 35 U.S.C. §103 is not whether an improvement or a use set forth in a patent would have been obvious or non-obvious; rather the test is whether the claimed invention, considered as a whole, would have been obvious. Jones v. Hardy, 110 U.S.P.Q. 1021, 1024 (Fed. Cir. 1984) (emphasis added). Thus, it is impermissible to focus either on the "gist" or "core" of the invention, Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc., 230 U.S.P.Q. 416, 420 (Fed. Cir. 1986). Moreover, the invention as a whole is not restricted to the specific subject matter claimed, but also embraces its

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properties and the problem it solves. In re Wright, 6 U.S.P.Q. 2d 1959, 1961 (Fed. Cir. 1988) (emphasis added).

Claims 5-9 and 12-16 are dependent directly or indirectly upon independent claim 1 and include additional features thereof.

Claim 5 (and similarly claims 6-9 and 12-16), which included the features of independent claim 1, recites in part:

"A method for streaming content striped in RAID 5 format from an array of disk drives to a plurality of subscribers to minimize disruptive service from a disk drive failure, said method comprising:
accessing content data on an extent-by-extent basis from a plurality of disk drives configured in an array;
streaming the content data to the plurality of subscribers on an extent-by-extent basis, sequentially, from the plurality of disk drives;
detecting an actual disk drive failure;
transitioning to a stream regeneration mode of operation comprising:
reading the content data contemporaneously from all extents in a parity group associated with a failed disk drive;
regenerating a failed portion of the content data from a failed extent in the parity group corresponding to the failed disk drive; and
streaming the content data in the parity group to the plurality of subscribers, extent-by-extent, immediately following the regenerating of the content data from the failed extent in the parity group."

Hanko does not teach or suggest "reading the content data contemporaneously from all extents in the parity group." Specifically, where a disk drive 320 has failed, the server 310 transitions from the carousel-serving algorithm 334 to the stream regeneration algorithm 339. The basic concept underlying the stream regeneration algorithm 339 is to switch from the RAID 5 format of reading each extent 402 one at a time, to the RAID 3-like format of reading the entire parity group simultaneously. In particular, the bad (i.e., failed) disk drive is no longer accessed, however, all the extents across the other disk drives 320 are read in the parity group 404. The parity information 410 is then used to reconstruct (regenerate) the missing true data from the defective disk drive. (See Applicants' specification, page 12, lines 17-26). By contrast, Hanko teaches away from the Applicants' invention, since each good drive is read in different

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preceding time slots when reconstructing the lost data. Therefore, Hanko fails to teach or suggest the Applicants' invention as a whole.

Furthermore, Peters fails to bridge the substantial gap as between Hanko and the Applicants' invention. Specifically, Peters discloses "[A]fter a storage unit fails, a new storage unit may be installed in its place, with lost data restored, or the lost data may be recreated and distributed over the remaining storage units." (See Peters, column 15, lines 37-40).

Therefore, even if the two references could somehow be operably combined, the combination would disclose reading data from the disk drives in different time slots to regenerate data for a failed disk drive, and installing a new disk drive to replace the failed disk drive. Accordingly, the Applicants' invention is different from the cited references, since the data is not read contemporaneously during regeneration, as claimed by the Applicants. Therefore the combined references fail to teach or suggest Applicants' invention as a whole.

As such, the Applicants submit that independent claim 1 is not obvious and fully satisfies the requirements of 35 U.S.C. §103 and is patentable over Hanko in view of Peters. For at least the same reasons as discussed above, the Applicants submit that dependent claims 5-9 and 12-16 are also not obvious and fully satisfy the requirements of 35 U.S.C. §103 and are patentable thereunder. Therefore, the Applicants respectfully request that the Examiner's rejection of claims 5-9 and 12-16 be withdrawn.

Claims 17-22

The Examiner has rejected claims 17-22 under 35 U.S.C. §103(a) as being unpatentable over Hanko in view of Brady et al. (USPN 5727144, hereinafter "Brady"). Applicants respectfully traverse the rejection.

Applicants' independent claim 17 recites:

"A method for streaming content striped in RAID 5 format from an array of disk drives to a plurality of subscribers to minimize disruptive service from a disk drive failure, said method comprising:
accessing content data on an extent-by-extent basis from a plurality of disk drives configured in an array;

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streaming the content data to the plurality of subscribers on an extent-by-extent basis, sequentially, from the plurality of disk drives;
predicting a disk drive failure;
writing content data from a the disk drive predicted to fail to spare extents on non-failed disk drives in the array;
detecting at least one of an actual failure and removal of the disk drive predicted to fail;
transitioning, in response to the detecting step, a recovery-carousel-serving mode of operation comprising:
streaming psuedo-sequentially, extent-by-extent, content data of each parity group to the plurality of subscribers, where the regenerated content data in a spare extent of each parity group is streamed out of sequence;
wherein in an instance where the disk drive predicted to fail fails prior to said writing step, said method further comprises
transitioning to a stream regeneration mode of operation comprising:
reading the content data contemporaneously from all extents in a parity group;
regenerating a failed portion of the content data from a failed extent in the parity group corresponding to the failed disk drive; and
streaming the content data in the parity group to the plurality of subscribers, extent-by-extent, immediately following the regenerating of the content data from the failed extent in the parity group." (emphasis added).

As discussed above, Hanko fails to disclose each and every element of the claimed invention, as arranged in the claim. In particular, Hanko does not teach or suggest "reading the content data contemporaneously from all extents in the parity group." Specifically, where a disk drive 320 has failed, the server 310 transitions from the carousel-serving algorithm 334 to the stream regeneration algorithm 339. The basic concept underlying the stream regeneration algorithm 339 is to switch from the RAID 5 format of reading each extent 402 one at a time, to the RAID 3-like format of reading the entire parity group simultaneously. In particular, the bad (i.e., failed) disk drive is no longer accessed, however, all the extents across the other disk drives 320 are read in the parity group 404. The parity information 410 is then used to reconstruct (regenerate) the missing true data from the defective disk drive. (See Applicants' specification, page 12, lines 17-26.) By contrast, Hanko teaches away from the Applicants' invention, since each good drive of Hanko is read in different preceding time slots. Therefore, each and

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every element of the claimed invention, arranged as in claim 1, is not taught, or even suggested, by Hanco. Therefore, Hanco fails to teach or suggest the Applicants' invention as a whole.

Furthermore, Brady fails to bridge the substantial gap as between Hanco and the Applicants' invention. Specifically, Brady discloses "[i]n a data processing system employing a disk array, prediction of a possible failure of a disk drive initiates copying of the data away from the potentially failing disk drive to a spare disk drive before the failing drive actually fails. If the disk drive does fail before the copying of the contents to a spare disk drive is completed, rebuilding of the remaining contents within the failing disk drive is performed. When a warning of an imminent disk failure is received, the present invention proceeds to copyaway state 21, wherein data is copied away from failing drive 110 to spare drive 112. When copyaway completes, the present invention returns to normal mode 20. It is well-known by those skilled in the art how to copy contents of drive 110 to drive 112.

Failing disk 110 may fail before the copyaway procedure is completed. In that case, a transition to rebuild mode 24 is performed, wherein a rebuilding of those portions of disk drive 110 that had not yet been copied away is performed.

Another error situation shown is when a disk other than the one for which the warning was initiated fails without warning (e.g., disk 111). For example, assume that a warning was initiated because of a pending failure of disk 110, which initiated I/O controller 180 to begin copying away from disk 110 to disk 112 in copyaway mode 21. During copyaway of disk 110, suppose that disk 111 fails. In this instance, a transition is made to the high priority copyaway state 22, where copyaway is given high priority and is no longer done in the background. This is because if disk 110 were to fail before copyaway of 110 completes, data would be lost. If copyaway does complete before disk 110 fails, a transition is made to rebuild state 24 where the contents of failed disk 111 are rebuilt." (See, Brady, Abstract, column 4, lines 15-38.)

Therefore, even if the two references could somehow be operably combined, the combination would still not disclose reading data in different time slots to regenerate data for a failed disk drive, and predicting a failure of a disk drive. Accordingly, the

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Applicants' invention is different from the cited references, since the data is not read contemporaneously, as claimed by the Applicants. Therefore the combined references fail to teach or suggest Applicants' invention as a whole.

As such, the Applicants submit that claim 17 is not obvious and fully satisfies the requirements of 35 U.S.C. §103 and is patentable thereunder. Claims 18-22 depend, directly or indirectly, from claim 17 and recite similar features thereof. As such, and for at least the same reasons as discussed above, the Applicants submit that claims 18-22 are also not obvious and fully satisfy the requirements of 35 U.S.C. §103 and are patentable thereunder. Therefore, the Applicants respectfully request that the rejections be withdrawn.

Claims 23-27

The Examiner has rejected claims 23-27 under 35 U.S.C. §103(a) as being unpatentable over Hanco in view of Brady in further view of Peters.

For at least the reasons discussed above, Applicants submit that independent claim 17 is not obvious and is patentable over Hanco in view of Brady. Claims 23-27 depend, directly or indirectly, upon independent claim 17 and recite similar features thereof. As such, and for at least the same reasons as discussed above, the Applicants submit that claims 23-27 are also not obvious and fully satisfy the requirements of 35 U.S.C. §103 and are patentable over Hanco in view of Brady.

Furthermore, Peters fails to bridge the substantial gap as between Hanco and Brady and the Applicants' invention. Specifically, as discussed above, Peters discloses installing a new disk drive to replace a failed disk drive in an array. (See Peters, column 15, lines 37-40).

Even if the three references could somehow be operably combined, the combination would not disclose reading data from the disk drives in different time slots to regenerate data of the failed disk, predicting disk failures, and replacing a failed disk drive with a new disk drive. Therefore the combined references fail to teach or suggest Applicants' invention as a whole, since the combined references fail to teach or suggest "reading the content data contemporaneously from all extents in the parity group."

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As such, the Applicants submit that independent claim 23 is not obvious and fully satisfies the requirements of 35 U.S.C. §103 and is patentable over Hanko and Brady in view of Peters. For at least the same reasons as discussed above, the Applicants submit that dependent claims 24-27 are also not obvious and fully satisfy the requirements of 35 U.S.C. §103 and are patentable thereunder. Therefore, the Applicants respectfully request that the Examiner's rejection of claims 23-27 be withdrawn.

Conclusion

Thus, the Applicants submit that claims 1-22 are in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issue are earnestly solicited.

If, however, the Examiner believes that there are any unresolved issues requiring adverse final action in any of the claims now pending in the application, it is requested that the Examiner telephone Steven M. Hertzberg or Eamon J. Wall, Esq. at (732) 530-9404 so appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

9/10/04

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